



Zenith

INTERNATIONAL PHD PROGRAM IN NEUROSCIENCE

**FRIDAY, 12 FEBRUARY 2021
AT 5:00 PM (CET)**

URS BÖHM

**DEPARTMENT OF CHEMISTRY AND CHEMICAL
BIOLOGY
HARVARD UNIVERSITY, USA**



ZENITH SEMINARS

VOLTAGE IMAGING IN THE ZEBRAFISH SPINAL CORD

To understand the function of a neural circuit it is essential to know the activity of the individual neurons that make up a given circuit. Established techniques such as calcium imaging or patch clamp electrophysiology lack either the temporal or spatial resolution necessary to investigate complex and fast dynamics in entire circuits. Voltage imaging can, in principle, overcome these limitations and recent advances in the development of genetically encoded voltage indicators made their application possible *in vivo*.

I will give a brief introduction of the principles of imaging neural activity with genetically encoded voltage indicators as well as an overview of the current state of the art sensors and their respective advantages. In my own work, I use voltage imaging and optogenetics in the zebrafish spinal cord as a model circuit to gain all-optical access to a complete and defined neural circuit. Imaging the electrical activity of many neurons in parallel while fish are swimming in a closed loop virtual environment, I was able to generate an overview of the firing characteristics of the entire set of excitatory spinal interneurons during locomotion. This dataset reveals a previously uncharacterized diversity of firing patterns during larval zebrafish slow swimming. In addition to rhythmic activity from neurons that make up the central pattern generator, I describe tonic spiking by the ventral-most V3. Based on further evidence from optogenetic activation and cell ablations, I propose that tonic activity in V3 neurons provides a system to modulate swim power without changing the frequency of the central pattern generator.

Urs Böhm is currently a postdoc fellow in the lab of Adam Cohen at Harvard University where he explores how to use voltage imaging to learn new things about the spinal cord. Previously he studied Biology in Freiburg and Singapore and has been working with zebrafish since his Masters. For his PhD, he joined Claire Wyart's lab at the ICM in Paris working on the role of mechanosensing neurons in the spinal cord.

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